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# NATIONAL AIR INTELLIGENCE CENTER



CERTAUB OGTSUCAL PROPERTIES OF LANTHANUM DIGERMANIDE

by

Yu. B. Paderno, O.B. Goncharuk, V.M. Makarchenko



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**HUMAN TRANSLATION**

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# U. S. BOARD ON GEOGRAPHIC NAMES transliteration SYSTEM

Block	Italic	Transliteration	Block	Italic	Transliteration
А а	<i>А а</i>	A, a	Р р	<i>Р р</i>	R, r
В в	<i>В в</i>	B, b	С с	<i>С с</i>	S, s
В в	<i>В в</i>	V, v	Т т	<i>Т т</i>	T, t
Г г	<i>Г г</i>	G, g	У у	<i>У у</i>	U, u
Д д	<i>Д д</i>	D, d	Ф ф	<i>Ф ф</i>	F, f
Е е	<i>Е е</i>	Ye, ye; E, e <sup>o</sup>	Х х	<i>Х х</i>	Kh, kh
Ж ж	<i>Ж ж</i>	Zh, zh	Ц ц	<i>Ц ц</i>	Ts, ts
З з	<i>З з</i>	Z, z	Ч ч	<i>Ч ч</i>	Ch, ch
И и	<i>И и</i>	I, i	Ш ш	<i>Ш ш</i>	Sh, sh
Й й	<i>Й й</i>	Y, y	Щ щ	<i>Щ щ</i>	Shch, shch
К к	<i>К к</i>	K, k	Ъ ъ	<i>Ъ ъ</i>	"
Л л	<i>Л л</i>	L, l	Ы ы	<i>Ы ы</i>	Y, y
М м	<i>М м</i>	M, m	Ь ь	<i>Ь ь</i>	'
Н н	<i>Н н</i>	N, n	Э э	<i>Э э</i>	E, e
О о	<i>О о</i>	O, o	Ю ю	<i>Ю ю</i>	Yu, yu
П п	<i>П п</i>	P, p	Я я	<i>Я я</i>	Ya, ya

<sup>o</sup>ye initially, after vowels, and after ъ, ы; g elsewhere.  
When written as ѣ in Russian, transliterate as yě or ě.

## RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	sinh <sup>-1</sup>
cos	cos	ch	cosh	arc ch	cosh <sup>-1</sup>
tg	tan	th	tanh	arc th	tanh <sup>-1</sup>
ctg	cot	cth	coth	arc cth	coth <sup>-1</sup>
sec	sec	sch	sech	arc sch	sech <sup>-1</sup>
cosec	csc	csch	csch	arc csch	csch <sup>-1</sup>

## Russian English

rot	curl
lg	log

## GRAPHICS DISCLAIMER

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## CERTAIN PHYSICAL PROPERTIES OF LANTHANUM DIGERMANIDE

Yu. B. Paderno, O. B. Goncharuk, and V. M. Makarchenko

(Presented by I. M. Prantsevich, Member Academy of Sciences, Ukrainian SSR)

### Summary

The authors carried out an investigation of the physical properties of lanthanum digermanide on samples obtained by sintering the components and subsequent smelting in an argon atmosphere. On the basis of the results obtained the conclusion was drawn that lanthanum digermanide possesses semiconductor properties.

In recent years, there has been a considerable rise in the interest to study the refractile compounds of the rare-earth metals in connection with quests for materials with special physical properties.

The properties of compounds of germanium with the rare-earth metals are virtually unknown; Only the existence of phases of the composition of  $\text{MeGe}_2$  and  $\text{MeGe}$  are known in these systems, and their crystalline structures have been established for the germanides of certain metals [1-4].

This work is dealing with an investigation of a number of physical properties of lanthanum digermanide on samples obtained by sintering the components and subsequent smelting in an argon atmosphere. The chemical composition of the samples (La - 45.4%, Ge - 54.4%) diverged somewhat towards an increase in the amount of germanium; the phase x-ray analysis did not show the presence of another phase, although a microstructural investigation revealed the presence of isolation, apparently, of eutectic of  $\text{LaGe}_2$ -Ge along the edges of grains. A similar effect was observed in work [1] during a study of the Pr-Ge system.

The phase obtained possesses:

specific electrical resistance at room	
temperature .....	659 $\mu\Omega\cdot\text{cm}$
microhardness .....	375 $\text{kg/mm}^2$
thermal expansion coefficient in	
the temperature range 0-800° .....	$8.9\cdot 10^{-6} \text{ deg}^{-1}$

The results of observation of the temperature dependence of the electrical resistance, thermal emf, and work function of the lanthanum germanide electrons are shown in Figs. 1-3.

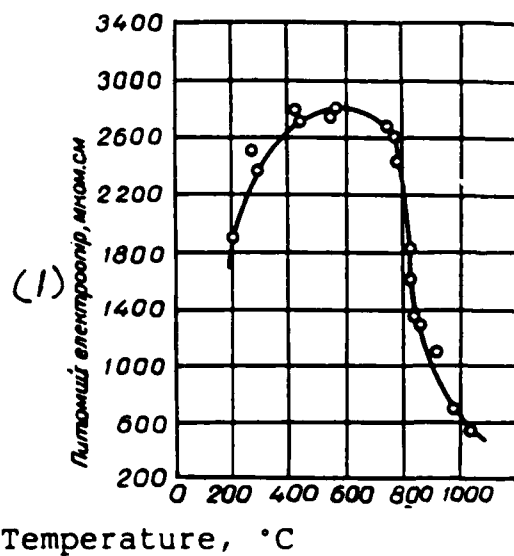


Fig. 1. Dependence of specific electrical resistance of lanthanum digermanide on temperature.

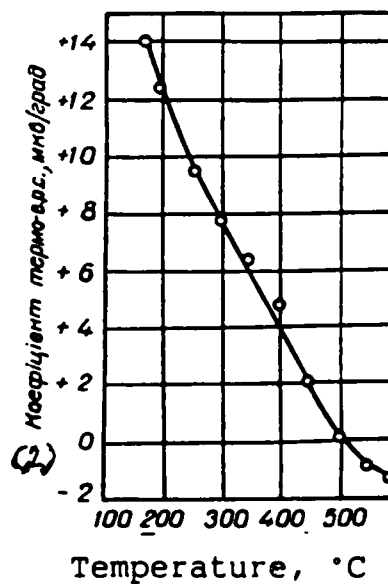


Fig. 2. Temperature dependence of thermal emf of lanthanum digermanide.

KEY: (1) Specific electrical resistance,  $\text{m}\Omega\cdot\text{cm}$ . (2) Thermal-emf coefficient,  $\text{mV}/\text{deg}$

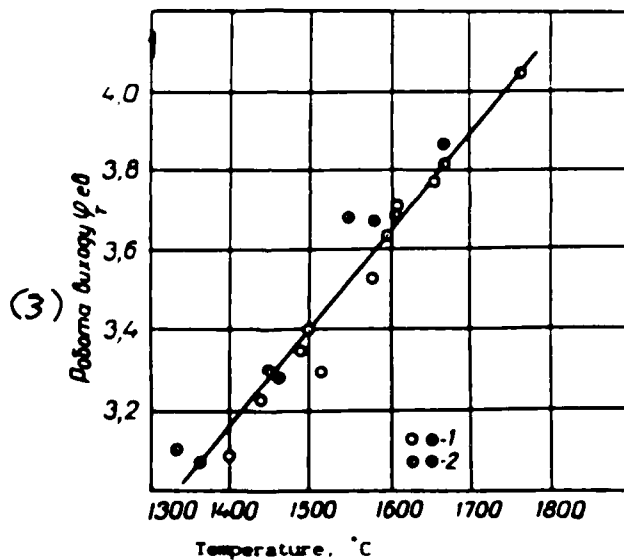


Fig. 3. Temperature dependence of the work function of the lanthanum digermanide electrons.

KEY: (1) - heating and cooling; (2) - repeated heating and cooling. (3) Work function,  $\text{eV}$

As can be seen from Figs. 1 and 2, there is a change in the nature of conductivity in lanthanum digermanide in the temperature range 500-600°. A similar effect was observed in work [5] in the investigation of isomorphous lanthanum disilicide. Apparently, in this interval of temperatures there occurs a transition from the extrinsic to the intrinsic conductivity; the negative quantity is characteristic for materials with a negative sign of current carriers. Using the temperature dependence to calculate resistance, the value of the activation energy of the current carriers comprised 0.3 eV.

On the basis of the results obtained, it is possible to make a conclusion that lanthanum germanide possesses semiconductor properties and, having comparatively high melting point (close to 1500°), poses an interest for further, more thorough investigations.

### Literature

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